COUPLING TOP-DOWN AND BOTTOM-UP RESTORATION PARADIGMS TO ENHANCE BIOGEOCHEMCIAL CYCLING, ECOSYSTEM SERVICES, AND BIODIVERSITY IN THE HACKENSACK MEADOWLANDS

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Ecosystems organize themselves around flows of matter and energy, - all the more critical for the Hackensack Meadowlands, which serves as a major center for ecosystem services and biodiversity in the densest metropolitan region in the country. While management of the Meadowlands has taken large steps forward in recent years, two essential features of ecosystem growth and development could favorably contribute to its sustainability:

1) the enhancement of habitat and structural diversity of landward, intertidal, and benthic environments;
2) maximizing biogeochemical filtration through a zero-discharge stormwater policy, as well as creation and extension of marshes, mudflats, mussel beds and oyster reefs.

While not fully understood, structural diversity of landscapes, waterbodies, intertidal and benthic environments regulates biological diversity, including the length and complexity of food chains. Habitat types from low and high marsh to reed-grass meadow provide some diversity, but could be well augmented by hypothesis-driven, properly scaled restoration of Atlantic white cedar, wild rice, shrub-scrub, swamp forest, and other native plant communities.

Since the highest predator strongly affects food web structure, raven reintroduction in the Meadowlands is a substantial step in ecosystem restoration. To carry this forward, habitat restoration for insectivores, for example, could favorably contribute to both human and ecosystem health. Textured surfaces under bridges to attract nesting swallows, bat houses, and nesting boxes for phoebes and other insect eating birds could create habitat for some of the species only recently absent in meadowlands and surroundings. Hawk and owl platforms and boxes, and tree copses planted away from human contact to provide future heron rookeries, directed by specific hypotheses on habitat features attractive to targeted species, can help to develop integral management tools.

Human built structures including warehouses and parking lots presently provide no ecological value. Greenroofs on such structures could provide protected zones for native plant meadow and shrublands, as well as a refugia for ground-nesting and other birds species vulnerable to raccoon, cat and other terrestrial predators adapted to life near human habitation. Parking lots and roadways outfitted with below-grade cisterns could capture a million gallons of stormwater/acre, decreasing pollutant loads, charging local water tables and increasing plant survival, primary productivity and base flow into the Hackensack and its tributaries.

Discharges from seven wastewater treatment plants, nearly seventy industrial facilities, and thirty two combined sewers put the Hackensack at risk. Opportunities exist to both decrease inputs and increase the scale of filters in the estuary to remove pollutants and increase habitat. Salinity, flow, bacteria and plankton content, and potential fish habitat maps may be used to site oyster reefs for filtration and biodiversity enhancement. About a hundred acres of oyster reef would, conservatively estimated, filter the full 400 cubic foot per second base flow of the Hackensack. Marsh, eelgrass, and mussels beds could be used with oyster reefs to create a habitat mosaic, adding value which could be measured in terms of water quality enhancement and biodiversity impacts.